

PyPalEx

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Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all documented namespaces with brief descriptions:

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Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

pypalex.Extractor.Extractor	
Extracts colors using ONLY the colors in the image	27

Chapter 3

Namespace Documentation

3.1 pypalex.__main__ Namespace Reference

Main script for PyPalEx.

Functions

- def `thread_helper` (extractor)
Supports multiprocessing color extraction operations.
- def `extract_color_palettes` ()
Handles multiprocessing color extraction from image(s).
- def `set_global_args` (args)
Sets the global variables using the arguments.
- def `check_source` (image_path)
Checks to make sure the path is either a file or directory.
- def `check_sources` (image_paths, directory=None)
Checks each of the sources provided.
- def `check_path` (full_path)
Check the full path to make sure the directory exists.
- def `setup_argument_parser` ()
Sets up the argument parser for command line arguments.
- def `handle_args` ()
Handles the arguments passed to PyPalEx.
- def `main` ()
Main script function.

Variables

- list `EXTRACTORS` = []
- list `PROPER_IMAGES` = []
- list `OUTPUT_DIRS` = []
- string `OUTPUT_DIR` = "
- string `OUTPUT_TAIL` = "-color_palette.json"

3.1.1 Detailed Description

Main script for PyPalEx.

Author

AI Timofeyev

Date

February 2, 2022

This tool is for extracting color palettes from images.

3.1.2 Function Documentation

3.1.2.1 `check_path()`

```
def pypalex.__main__.check_path (
    full_path )
```

Check the full path to make sure the directory exists.

Parameters

<i>full_path</i>	The full path to directory.
------------------	-----------------------------

Returns

Boolean flag: True if directory exists and is not a file, False otherwise.

3.1.2.2 `check_source()`

```
def pypalex.__main__.check_source (
    image_path )
```

Checks to make sure the path is either a file or directory.

Parameters

<i>image_path</i>	Path to image with filename and file extension (.jpg, .png, etc.).
-------------------	--

Returns

Boolean flag: True if file exists, False otherwise.

3.1.2.3 check_sources()

```
def pypalex.__main__.check_sources (
    image_paths,
    directory = None )
```

Checks each of the sources provided.

Parameters

<i>image_paths</i>	Array of image paths.
<i>directory</i>	A directory path to the images, if it is provided.

Returns

Boolean flag: True if all/some sources are good, False if all sources are bad.

3.1.2.4 set_global_args()

```
def pypalex.__main__.set_global_args (
    args )
```

Sets the global variables using the arguments.

Parameters

<i>args</i>	User-supplied arguments.
-------------	--------------------------

3.1.2.5 setup_argument_parser()

```
def pypalex.__main__.setup_argument_parser ( )
```

Sets up the argument parser for command line arguments.

Returns

A command line argument parsing object.

3.1.2.6 thread_helper()

```
def pypalex.__main__.thread_helper (
    extractor )
```

Supports multiprocessing color extraction operations.

Parameters

<i>extractor</i>	The Extractor object for which to run extraction process.
------------------	---

Returns

The [Extractor](#) object.

3.2 pypalex.arg_messages Namespace Reference

Archive of messages to display for arguments supplied by user.

Functions

- def [bad_source_message](#) ()
Returns an error message if the sources provided were not images.
- def [bad_directory_message](#) ()
Returns an error message if the directory provided is not a valid directory.
- def [no_args_help_message](#) ()
Returns a help message if no arguments were presented.

3.2.1 Detailed Description

Archive of messages to display for arguments supplied by user.

Author

AI Timofeyev

Date

March 3, 2022

3.2.2 Function Documentation

3.2.2.1 bad_directory_message()

```
def pypalex.arg_messages.bad_directory_message ( )
```

Returns an error message if the directory provided is not a valid directory.

Returns

The "bad directory" message.

3.2.2.2 bad_source_message()

```
def pypalex.arg_messages.bad_source_message ( )
```

Returns an error message if the sources provided were not images.

Returns

The "bad sources" message.

3.2.2.3 no_args_help_message()

```
def pypalex.arg_messages.no_args_help_message ( )
```

Returns a help message if no arguments were presented.

Returns

The "no arguments" help message.

3.3 pypalex.conversion_utils Namespace Reference

Utilities for converting between RGB, HSL, HEX.

Functions

- def `rgb_to_hsl` (rgb_array)
Convert rgb array [r, g, b] to hsl array [h, s, l].
- def `hsl_to_rgb` (hsl_array)
Convert hsl array [h, s, l] to rgb array [r, g, b].
- def `rgb_to_hex` (rgb_array)
Convert rgb array [r, g, b] to hex string 'ffffff'.

3.3.1 Detailed Description

Utilities for converting between RGB, HSL, HEX.

Author

AI Timofeyev

Date

February 2, 2022

3.3.2 Function Documentation

3.3.2.1 `hsl_to_rgb()`

```
def pypalex.conversion_utils.hsl_to_rgb (  
    hsl_array )
```

Convert hsl array [h, s, l] to rgb array [r, g, b].

HSL where h is in the set [0, 359] and s, l are in the set [0.0, 100.0]. RGB where r, g, b in the set [0, 255]. Formula adapted from <https://www.rapidtables.com/convert/color/hsl-to-rgb.html>

Parameters

<i>hsl_array</i>	HSL array [h, s, l].
------------------	----------------------

Returns

RGB array [r, g, b].

3.3.2.2 rgb_to_hex()

```
def pypalex.conversion_utils.rgb_to_hex (
    rgb_array )
```

Convert rgb array [r, g, b] to hex string 'ffffff'.

RGB where r, g, b are in the set [0, 255]. Hex string in set ["000000", "ffffff"].

Parameters

<i>rgb_array</i>	RGB array [r, g, b].
------------------	----------------------

Returns

Hex string 'ffffff'

3.3.2.3 rgb_to_hsl()

```
def pypalex.conversion_utils.rgb_to_hsl (
    rgb_array )
```

Convert rgb array [r, g, b] to hsl array [h, s, l].

RGB where r, g, b are in the set [0, 255]. HSL where h in the set [0, 359] and s, l in the set [0.0, 100.0]. Formula adapted from <https://www.rapidtables.com/convert/color/rgb-to-hsl.html>

Parameters

<i>rgb_array</i>	RGB array [r, g, b].
------------------	----------------------

Returns

HSL array [h, s, l].

3.4 pypalex.extraction_utils Namespace Reference

Utilities for extracting colors from the image.

Functions

- def [extract_ratios](#) (hsl_img_array)
Extracts the ratios of hues per pixel.
- def [construct_base_color_dictionary](#) (hsl_img_array)
Constructs dictionary of base colors from array of hsl pixel values.
- def [check_missing_colors](#) (base_color_dict)
Checks for any missing colors in the base color dictionary and borrows them from the surrounding colors.
- def [borrow_for_color_red](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color red.
- def [borrow_for_color_yellow](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color yellow.
- def [borrow_for_color_green](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color green.
- def [borrow_for_color_cyan](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color cyan.
- def [borrow_for_color_blue](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color blue.
- def [borrow_for_color_magenta](#) (base_color_dict, from_left, from_right)
Borrows colors for the base color magenta.
- def [extract_dominant_colors](#) (base_color_dict)
Extracts dominant light, normal, dark colors from each of the base colors.
- def [extract_colors](#) (hsl_base_color_array)
Extracts the dominant light, normal, dark colors from the color array.
- def [sort_by_light_value](#) (hsl_base_color_array)
Sorts the colors array by the lightness value and returns three separate color arrays.
- def [extract_dominant_color](#) (hsl_colors)
Extracts the dominant color from the hsl color array.
- def [get_dom_hue_colors](#) (hsl_colors)
Construct list/array of a base color with the dominant hue.
- def [get_dom_sat_colors](#) (hsl_colors)
Construct list/array of a base color with the dominant saturation.
- def [get_dom_lit_colors](#) (hsl_colors)
Construct list/array of a base color with the dominant lightness.

- def `check_colors` (light_color, norm_color, dark_color)
Checks to make sure all the color types have been properly set by <extract_colors()> function.
- def `check_sat_and_light` (hsl_color)
Normalize saturation and lightness so that saturation isn't completely 0% and that lightness isn't 0% or 100%.
- def `generate_remaining_colors` (dom_color_dict, ratios)
Generate the remaining black and white, and background and foreground colors.
- def `get_color_extremes` (ratios)
Determines the most and least dominant color in the image.
- def `generate_black_and_white` (hsl_color)
Generate a black and white color using the hsl_color.
- def `generate_background_and_foreground` (most_dom_hsl_color, least_dom_hsl_color)
Generates the background and foreground colors based on the most and least dominant colors.

3.4.1 Detailed Description

Utilities for extracting colors from the image.

Author

AI Timofeyev

Date

February 10, 2022

3.4.2 Function Documentation

3.4.2.1 `borrow_for_color_blue()`

```
def pypalex.extraction_utils.borrow_for_color_blue (
    base_color_dict,
    from_left,
    from_right )
```

Borrows colors for the base color blue.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.2 borrow_for_color_cyan()

```
def pypalex.extraction_utils.borrow_for_color_cyan (  
    base_color_dict,  
    from_left,  
    from_right )
```

Borrows colors for the base color cyan.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.3 borrow_for_color_green()

```
def pypalex.extraction_utils.borrow_for_color_green (  
    base_color_dict,  
    from_left,  
    from_right )
```

Borrows colors for the base color green.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.4 borrow_for_color_magenta()

```
def pypalex.extraction_utils.borrow_for_color_magenta (
    base_color_dict,
    from_left,
    from_right )
```

Borrows colors for the base color magenta.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.5 borrow_for_color_red()

```
def pypalex.extraction_utils.borrow_for_color_red (
    base_color_dict,
    from_left,
    from_right )
```

Borrows colors for the base color red.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.6 borrow_for_color_yellow()

```
def pypalex.extraction_utils.borrow_for_color_yellow (
    base_color_dict,
    from_left,
    from_right )
```

Borrows colors for the base color yellow.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
<i>from_left</i>	Boolean flag for recursive calls, if we came from the left.
<i>from_right</i>	Boolean flag for recursive calls, if we came from the right.

Returns

A list/array sample of a potential color substitute.

3.4.2.7 check_colors()

```
def pypalex.extraction_utils.check_colors (
    light_color,
    norm_color,
    dark_color )
```

Checks to make sure all the color types have been properly set by [<extract_colors\(\)>](#) function.

Parameters

<i>light_color</i>	Light hsl color.
<i>norm_color</i>	Normal hsl color.
<i>dark_color</i>	Dark hsl color.

3.4.2.8 check_missing_colors()

```
def pypalex.extraction_utils.check_missing_colors (
    base_color_dict )
```

Checks for any missing colors in the base color dictionary and borrows them from the surrounding colors.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
------------------------	--

3.4.2.9 check_sat_and_light()

```
def pypalex.extraction_utils.check_sat_and_light (
    hsl_color )
```

Normalize saturation and lightness so that saturation isn't completely 0% and that lightness isn't 0% or 100%.

Parameters

<i>hsl_color</i>	An hsl color in list/array format [h, s, l].
------------------	--

3.4.2.10 construct_base_color_dictionary()

```
def pypalex.extraction_utils.construct_base_color_dictionary (
    hsl_img_array )
```

Constructs dictionary of base colors from array of hsl pixel values.

Parameters

<i>hsl_img_array</i>	2D Array of pixels in hsl array format.
----------------------	---

Returns

Dictionary of base colors.

3.4.2.11 extract_colors()

```
def pypalex.extraction_utils.extract_colors (
    hsl_base_color_array )
```

Extracts the dominant light, normal, dark colors from the color array.

Parameters

<i>hsl_base_color_array</i>	2D Array of hsl colors from one of the base colors.
-----------------------------	---

Returns

List/Array of dominant light, normal, dark colors in hsl format.

3.4.2.12 extract_dominant_color()

```
def pypalex.extraction_utils.extract_dominant_color (
    hsl_colors )
```

Extracts the dominant color from the hsl color array.

Parameters

<i>hsl_colors</i>	2D Array of hsl colors from one of the base colors [Red, Green, Blue, etc.].
-------------------	--

Returns

A dominant color list/array in hsl format [h, s, l].

3.4.2.13 extract_dominant_colors()

```
def pypalex.extraction_utils.extract_dominant_colors (
    base_color_dict )
```

Extracts dominant light, normal, dark colors from each of the base colors.

Parameters

<i>base_color_dict</i>	Dictionary with arrays of all the base colors.
------------------------	--

Returns

Dictionary of light, normal, dark colors for each of the base colors.

3.4.2.14 extract_ratios()

```
def pypalex.extraction_utils.extract_ratios (
    hsl_img_array )
```

Extracts the ratios of hues per pixel.

Parameters

<i>hsl_img_array</i>	2D Array of pixels in hsl array format.
----------------------	---

Returns

Dictionary of hue ratios (percentage) in set [0.000, 100.000]

3.4.2.15 generate_background_and_foreground()

```
def pypalex.extraction_utils.generate_background_and_foreground (
    most_dom_hsl_color,
    least_dom_hsl_color )
```

Generates the background and foreground colors based on the most and least dominant colors.

Parameters

<i>most_dom_hsl_color</i>	The hsl color array from which to generate background.
<i>least_dom_hsl_color</i>	The hsl color array from which to generate foreground.

Returns

List/array of background and foreground hsl colors.

3.4.2.16 generate_black_and_white()

```
def pypalex.extraction_utils.generate_black_and_white (
    hsl_color )
```

Generate a black and white color using the hsl_color.

Parameters

<i>hsl_color</i>	The hsl color array from which to generate black and white.
------------------	---

Returns

List/array of light, normal, dark black and white hsl colors.

3.4.2.17 generate_remaining_colors()

```
def pypalex.extraction_utils.generate_remaining_colors (
    dom_color_dict,
    ratios )
```

Generate the remaining black and white, and background and foreground colors.

Parameters

<i>dom_color_dict</i>	Dictionary of dominant light, normal, dark base colors.
<i>ratios</i>	Dictionary of ratios of the base colors in image.

3.4.2.18 get_color_extremes()

```
def pypalex.extraction_utils.get_color_extremes (
    ratios )
```

Determines the most and least dominant color in the image.

Parameters

<i>ratios</i>	Dictionary of ratios of the base colors in image.
---------------	---

Returns

List/array of most and least dominant color as strings.

3.4.2.19 get_dom_hue_colors()

```
def pypalex.extraction_utils.get_dom_hue_colors (
    hsl_colors )
```

Construct list/array of a base color with the dominant hue.

Example: From the `hsl_colors` array, there could be 10 hues that appear 4 times each, while the rest of the hues appear only once or twice. The `hsl_colors` with these 10 hues will be extracted and returned because they appear the most and are therefore the dominant hues.

Parameters

<i>hsl_colors</i>	2D Array of hsl colors from one of the base colors [Red, Green, Blue, etc.].
-------------------	--

Returns

List/array of all hsl colors that had the dominant number of hue values.

3.4.2.20 get_dom_lit_colors()

```
def pypalex.extraction_utils.get_dom_lit_colors (
    hsl_colors )
```

Construct list/array of a base color with the dominant lightness.

Example: From the `hsl_colors` array, there could be 2 lightness values that appear 8 times each, while the rest of the lightness values appear only once or twice. The `hsl_colors` with these 2 lightness values will be extracted and returned because they appear the most and are therefore the dominant lightness values.

Parameters

<i>hsl_colors</i>	2D Array of hsl colors from one of the base colors [Red, Green, Blue, etc.].
-------------------	--

Returns

List/array of all hsl colors that had the dominant number of lightness values.

3.4.2.21 get_dom_sat_colors()

```
def pypalex.extraction_utils.get_dom_sat_colors (
    hsl_colors )
```

Construct list/array of a base color with the dominant saturation.

Example: From the `hsl_colors` array, there could be 5 saturation values that appear 12 times each, while the rest of the saturation values appear only once or twice. The `hsl_colors` with these 5 saturation values will be extracted and returned because they appear the most and are therefore the dominant saturation values.

Parameters

<i>hsl_colors</i>	2D Array of hsl colors from one of the base colors [Red, Green, Blue, etc.].
-------------------	--

Returns

List/array of all hsl colors that had the dominant number of saturation values.

3.4.2.22 `sort_by_light_value()`

```
def pypalex.extraction_utils.sort_by_light_value (
    hsl_base_color_array )
```

Sorts the colors array by the lightness value and returns three separate color arrays.

Parameters

<code>hsl_base_color_array</code>	2D Array of hsl colors from one of the base colors.
-----------------------------------	---

Returns

List/Array of light, normal, and dark colors from the array of hsl colors.

3.5 `pypalex.Extractor` Namespace Reference

Extraction utility class for extracting colors from the image.

Classes

- class [Extractor](#)
Extracts colors using ONLY the colors in the image.

3.5.1 Detailed Description

Extraction utility class for extracting colors from the image.

Author

AI Timofeyev

Date

February 10, 2022

3.6 pypalex.image_utils Namespace Reference

Utilities for processing image and file handling.

Functions

- def `process_image` (image)
Processes PIL Image object.
- def `rescale_image` (img)
Rescales image to a smaller sampling size.
- def `thread_helper` (flat_img_array)
Helper function for multiprocessing conversion operations.
- def `save_palette_to_file` (color_palette, output_file)
Saves color palette to json file.

3.6.1 Detailed Description

Utilities for processing image and file handling.

Author

AI Timofeyev

Date

February 27, 2022

3.6.2 Function Documentation

3.6.2.1 `process_image()`

```
def pypalex.image_utils.process_image (  
    image )
```

Processes PIL Image object.

Multiprocessing example from: <https://stackoverflow.com/a/45555516>

Parameters

<i>image</i>	PIL Image object.
--------------	-------------------

Returns

List of full hsl arrays (pixels) of image.

3.6.2.2 rescale_image()

```
def pypalex.image_utils.rescale_image (
    img )
```

Rescales image to a smaller sampling size.

Parameters

<i>img</i>	The PIL.Image object.
------------	-----------------------

Returns

Tuple of the new width and height of image.

3.6.2.3 save_palette_to_file()

```
def pypalex.image_utils.save_palette_to_file (
    color_palette,
    output_file )
```

Saves color palette to json file.

If a file with the same name already exists, it is overwritten.

Parameters

<i>color_palette</i>	Dictionary of light, normal, and dark color palettes.
<i>output_file</i>	The output path/directory with filename at the end.

3.6.2.4 thread_helper()

```
def pypalex.image_utils.thread_helper (
    flat_img_array )
```

Helper function for multiprocessing conversion operations.

Helps convert from [r, g, b] to [h, s, l].

Parameters

<i>flat_img_array</i>	A flattened rgb portion of the original image array.
-----------------------	--

Returns

A numpy array of converted hsl values.

Chapter 4

Class Documentation

4.1 pypalex.Extractor.Extractor Class Reference

Extracts colors using ONLY the colors in the image.

Public Member Functions

- `def __init__ (self, full_hsl_img_array, output_path)`
Extractor Constructor.
- `def run (self)`
Performs extraction of colors.
- `def construct_palette_dictionary (self)`
Constructs color palette dictionary.

Public Attributes

- `output_path`
Output path and filename of where to store color palette.
- `full_hsl_img_array`
A 2D numpy array of all the pixels from image, in hsl format.
- `ratio_dict`
- `base_color_dict`
- `dom_color_dict`

4.1.1 Detailed Description

Extracts colors using ONLY the colors in the image.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 __init__()

```
def pypalex.Extractor.Extractor.__init__ (
    self,
    full_hsl_img_array,
    output_path )
```

[Extractor](#) Constructor.

Parameters

<i>self</i>	The object pointer.
<i>full_hsl_img_array</i>	A 2D numpy array of all the pixels from image, in hsl format.
<i>output_path</i>	Output path and filename of where to store color palette.

4.1.3 Member Function Documentation

4.1.3.1 `construct_palette_dictionary()`

```
def pypalex.Extractor.Extractor.construct_palette_dictionary (  
    self )
```

Constructs color palette dictionary.

Parameters

<i>self</i>	The object pointer.
-------------	---------------------

4.1.3.2 `run()`

```
def pypalex.Extractor.Extractor.run (  
    self )
```

Performs extraction of colors.

Parameters

<i>self</i>	The object pointer.
-------------	---------------------

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- `Extractor.py`

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